Operational Impact of the QPF Component of the 2011 Spring Experiment

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Motivation

Flooding is a leading cause of weather-related deaths

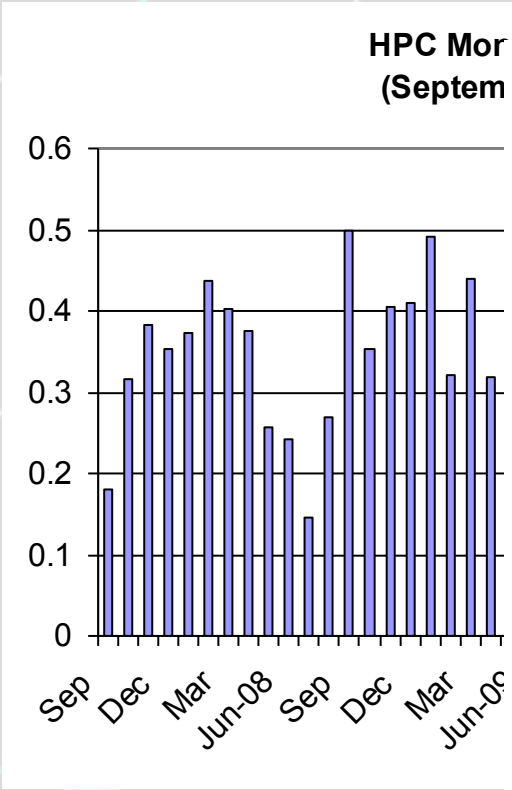
"Improvements in QPF and mesoscale rainfall prediction need to be a top NWS research and training priority.“

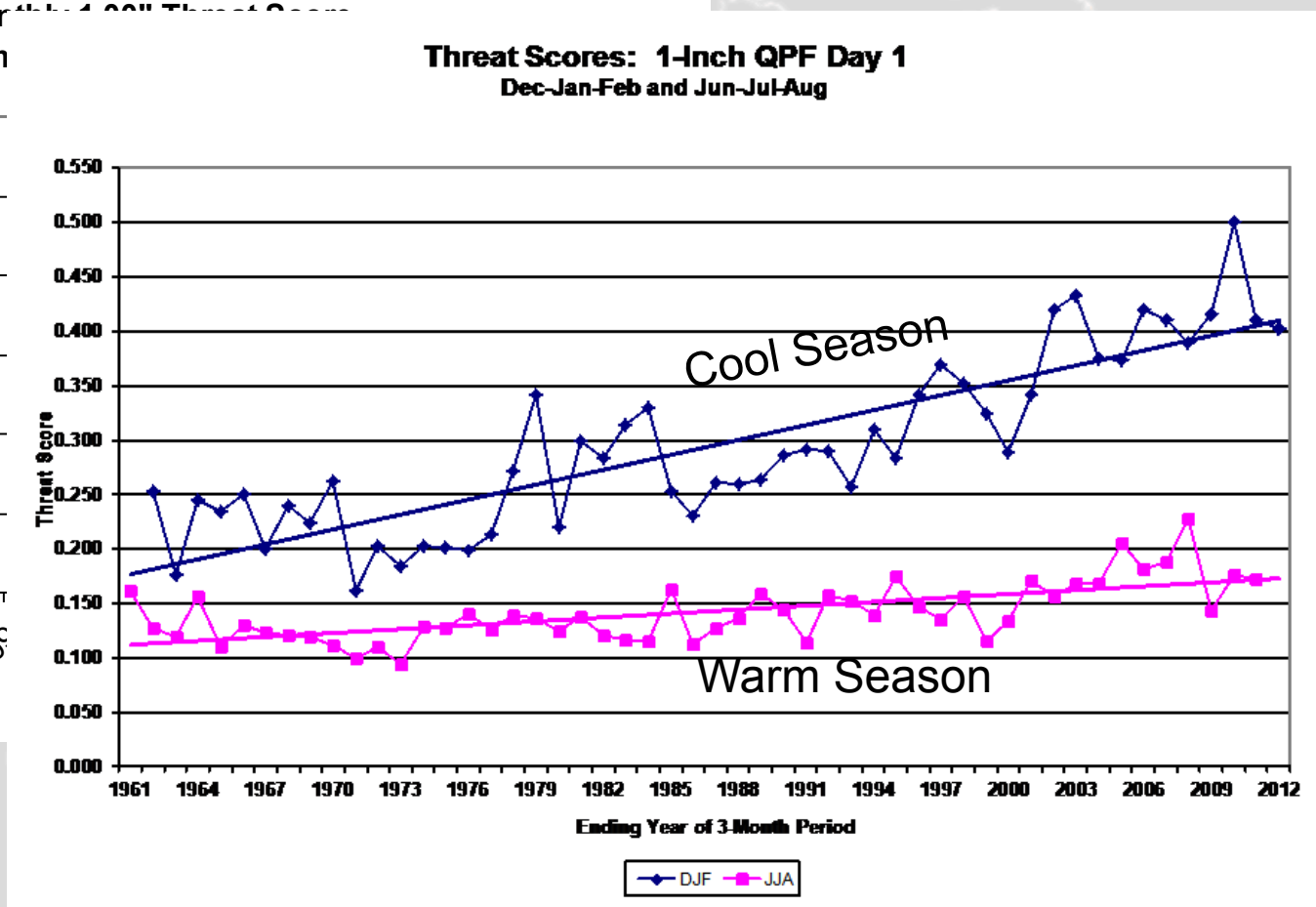
2009 SE US Flood Service Assessment

Motivation

"Warm season quantitative precipitation forecasts are, certifiably, the poorest performance area of forecast systems worldwide."

Fritsch and Carbone (2004)





2011 HWT Spring Experiment

May 9 – June 10, 2011

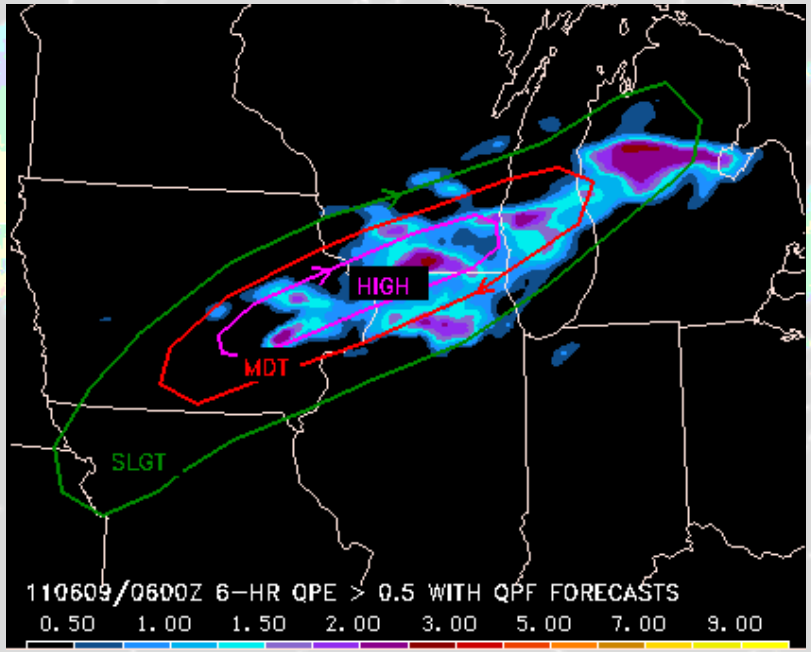
- 3 components
  - Severe
  - Convective initiation
  - QPF

- ~80 participants representing operations, research, and academia

QPF Component

- GOAL: Document the strengths and limitations of the high resolution model guidance for QPF and determine how to best use experimental and operational data in a complementary manner

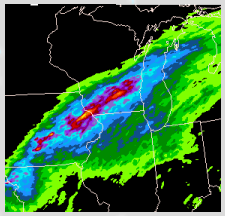
- Daily Activities
  - Probabilistic 6 hr QPFs
    - Valid 00Z, 06Z, and 12Z
    - 0.50” and 1.0” thresholds
    - Indicate highest possible amount within any 1.0” area
  - Forecast discussion
  - Subjective evaluation of experimental forecasts and model performance



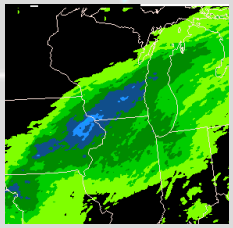
Experimental Model Guidance

Provider	Model	Delta X	Notes	Label
CAPS	WRF/ARPS 24 member ensemble	4 km	Multi-model, multi-physics, multi-IC ensemble system with radar assimilation	SSEF
SPC	WRF/NMMB 7 member ensemble	4 km	Combination of available high resolution deterministic runs	SSEO
EMC	NMMB	4 km and 12 km	Pre-implementation version of the NAM	NMMB
NSSL	WRF-ARW	4 km	NAM initial and boundary conditions	NSSL WRF-ARW
EMC	WRF-NMM	4 km	NAM initial and boundary conditions	NCEP HRW-NMM
EMC	WRF-ARW	5.1 km	NAM initial and boundary conditions	NCEP HRW-ARW
GSD	HRRR	3 km	Hourly updating with radar assimilation	HRRR
MDL	HRMOS	4 km	GFS-based statistical regression	HRMOS

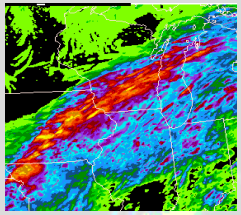
Experimental Ensemble Products



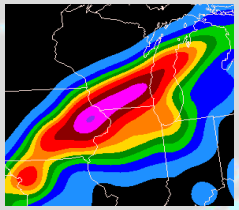
Probability matched mean—combines the spatial pattern of the ensemble mean QPF with the frequency distribution of the rainfall rates (Ebert 2001)



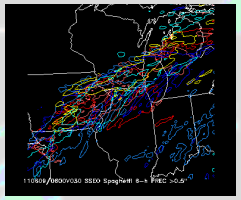
Bias corrected mean—running 14 day bias correction applied to 6hr QPF



Ensemble maximum—Maximum from any member



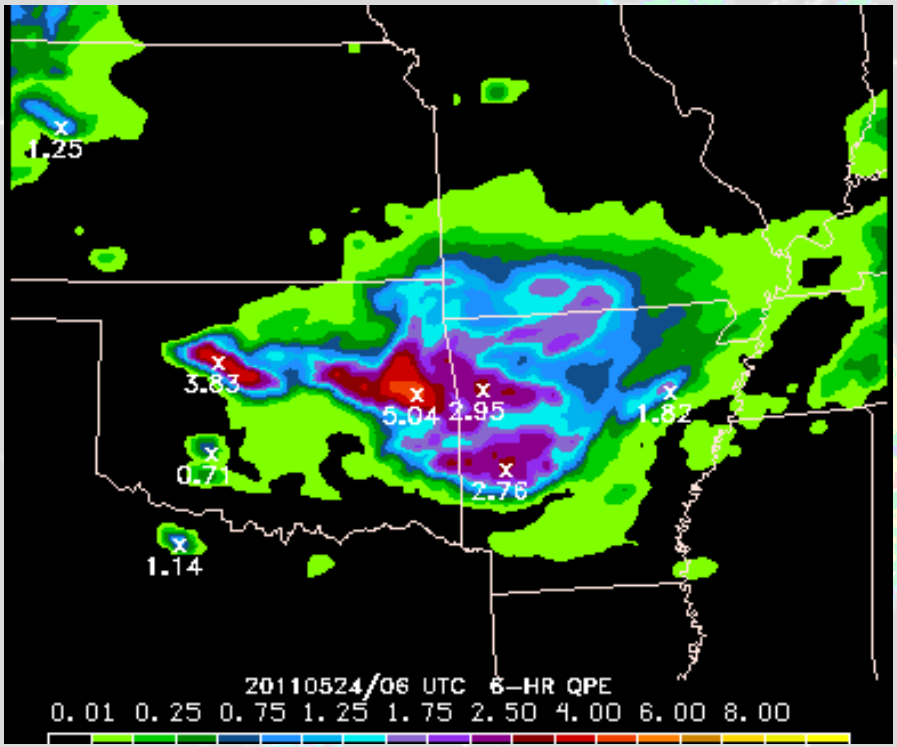
Neighborhood probabilities—probability of an event occurring in the vicinity of a point



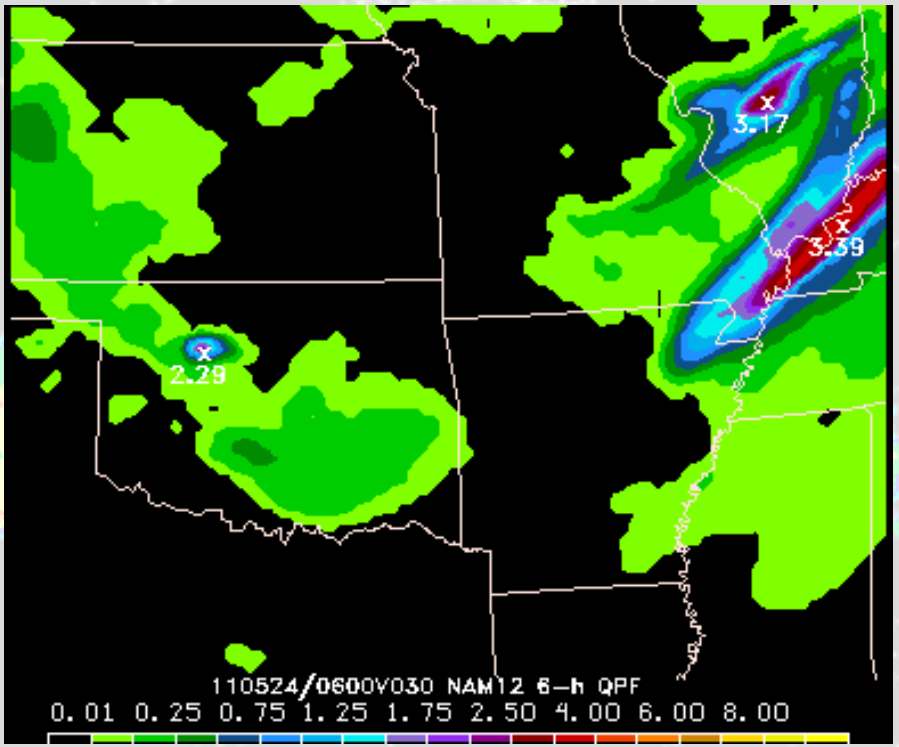
Spaghetti plots—contours outlining a selected precipitation amount

Forecast Valid 06Z 24 May 2011

6hr NSSLQ2 QPE valid 06Z 24 May 2011



12 km NAM 6 hr QPF (30 hr forecast)



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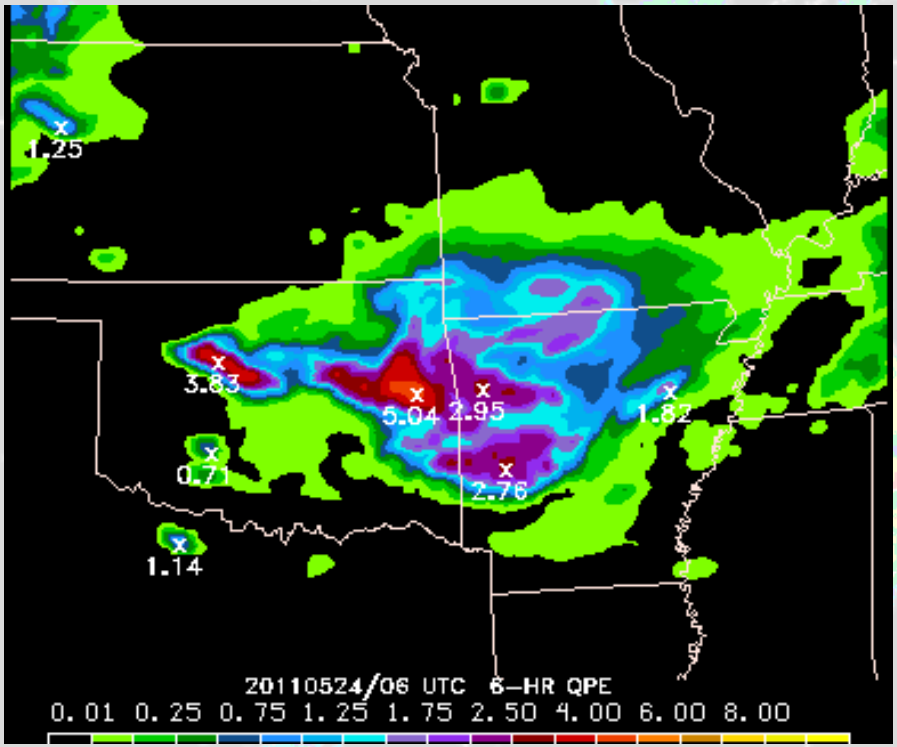
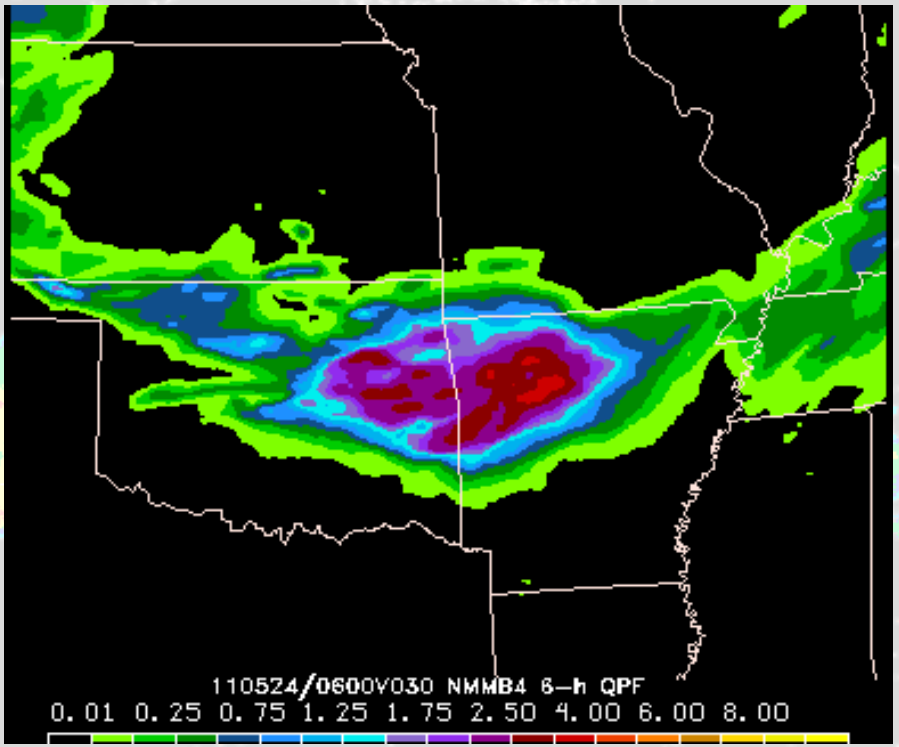
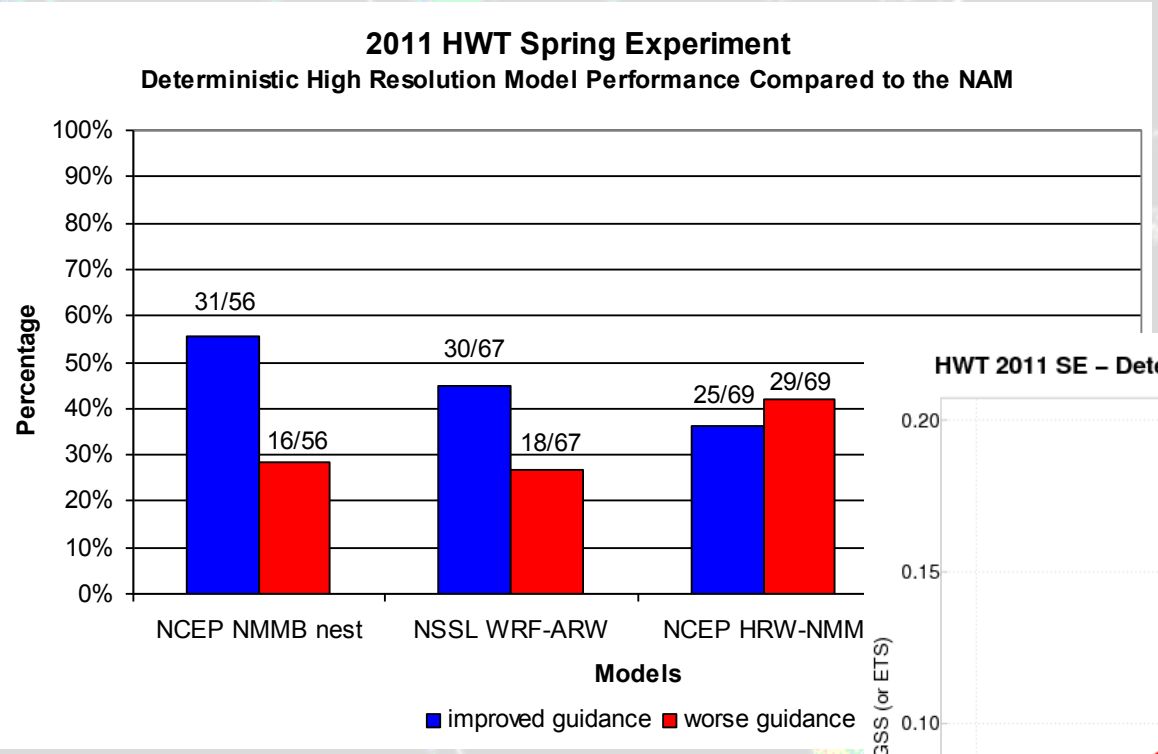


4 km NMMB 6 hr QPF (30 hr forecast)

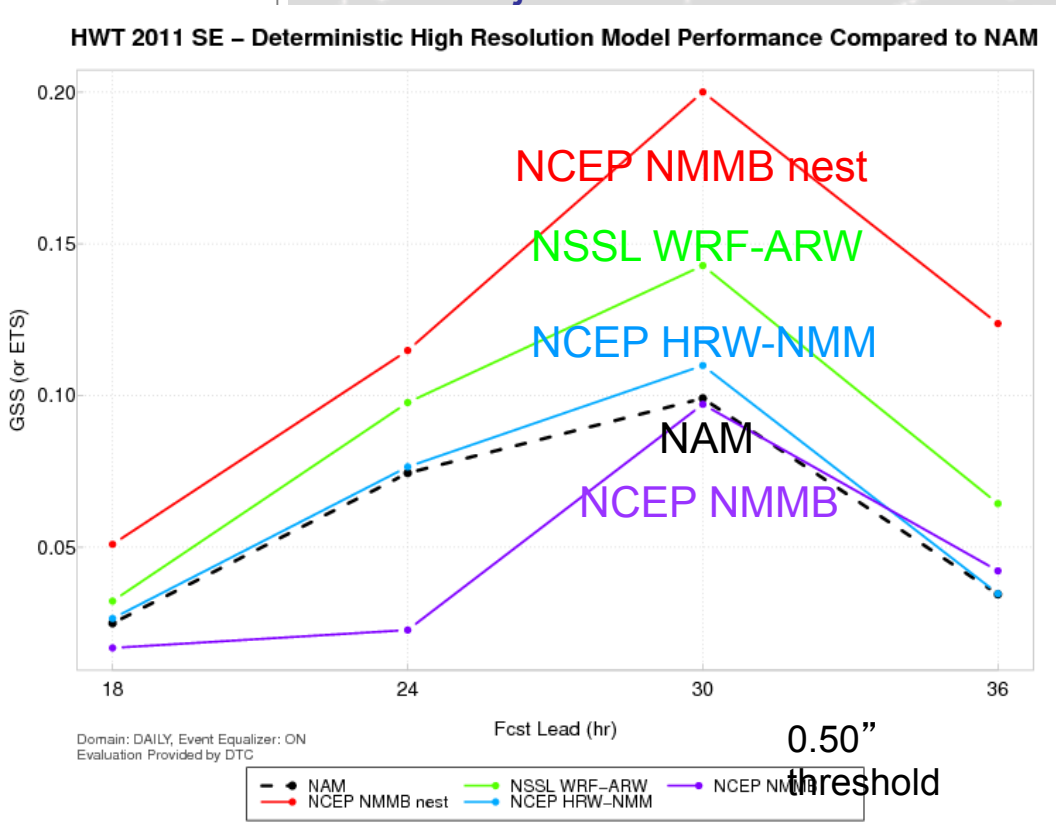


Results—Deterministic Models

Subjective Verification



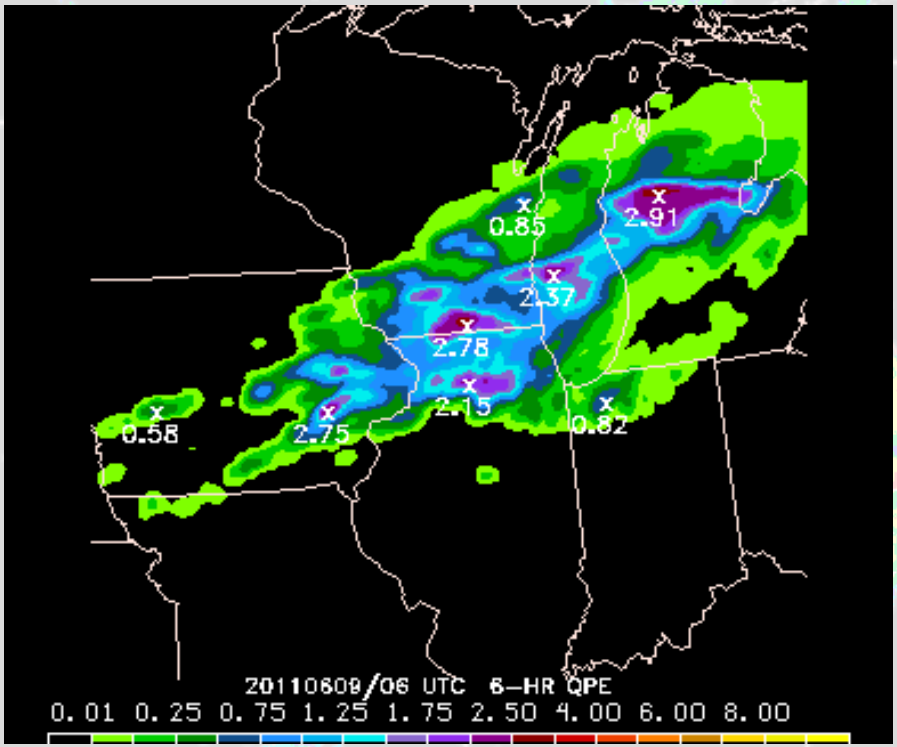
DTC Objective Verification



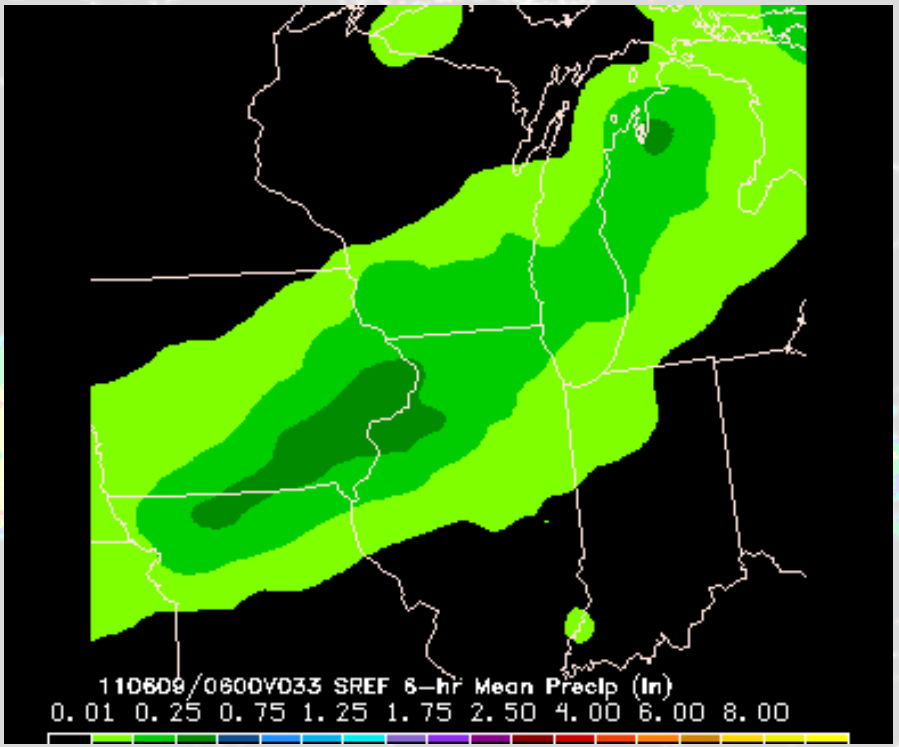
0.50” threshold

Forecast Valid 06Z 9 June 2011

6hr NSSLQ2 QPE valid 06Z 9 June 2011

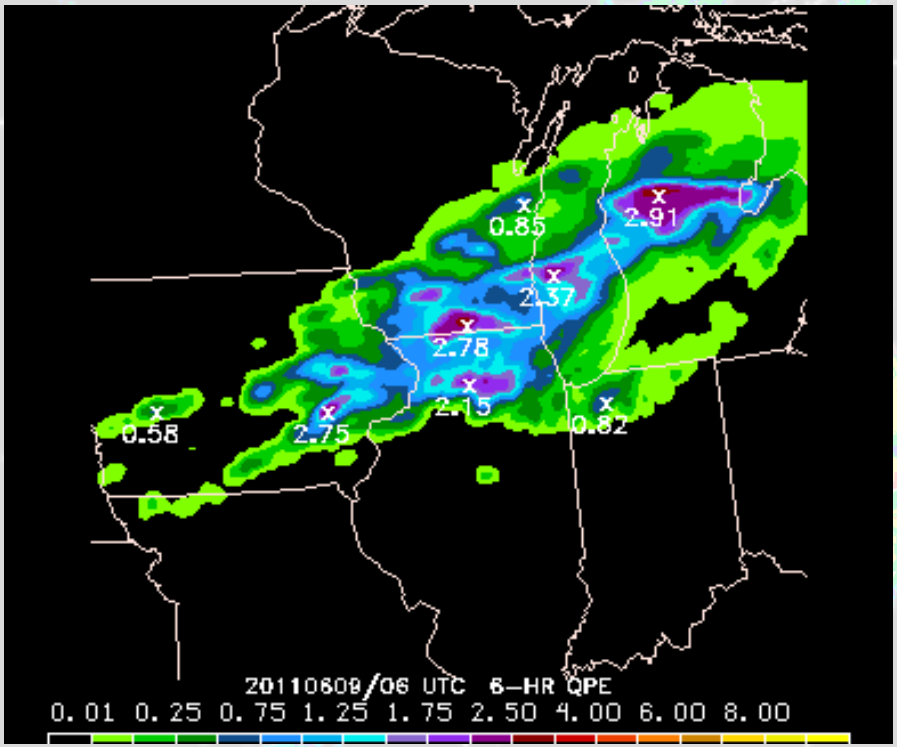


SREF mean 6 hr QPF (33 hr forecast)

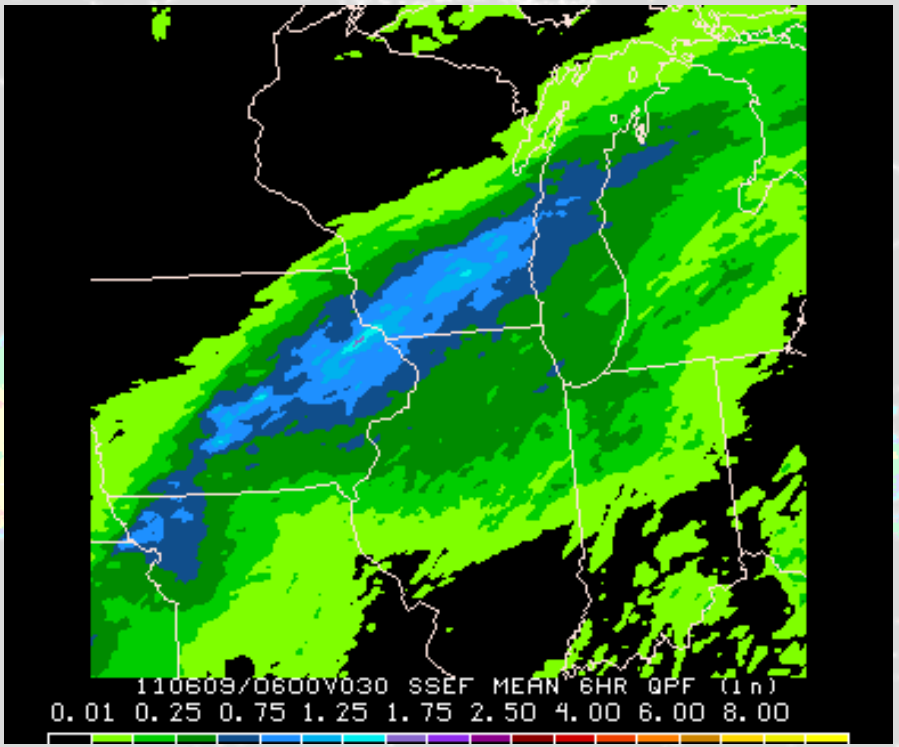


Forecast Valid 06Z 9 June 2011

6hr NSSLQ2 QPE valid 06Z 9 June 2011

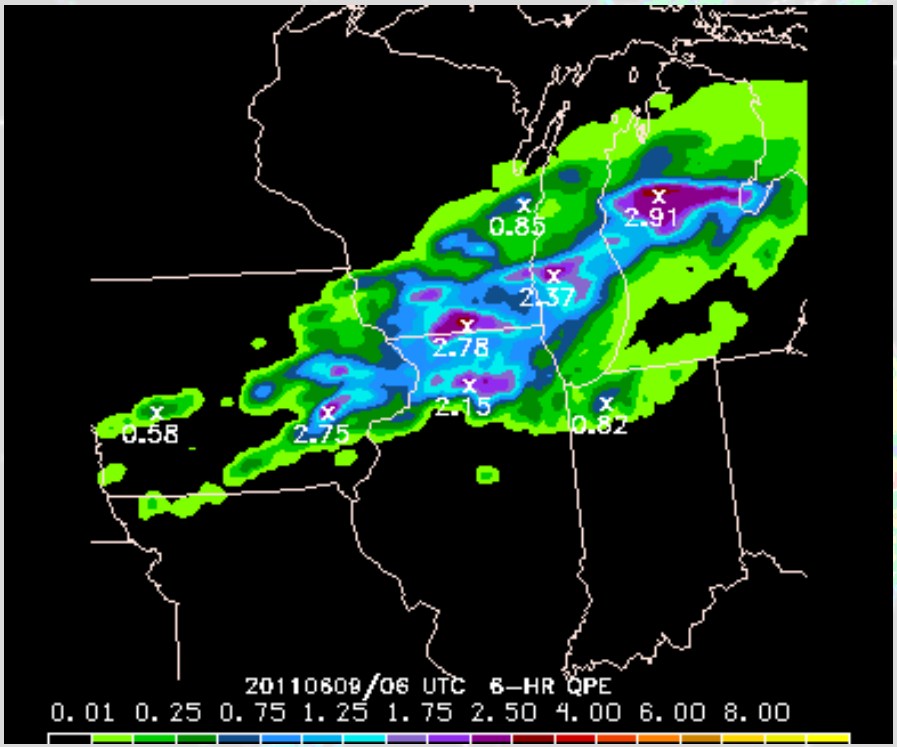


SSEF mean 6 hr QPF (30 hr forecast)

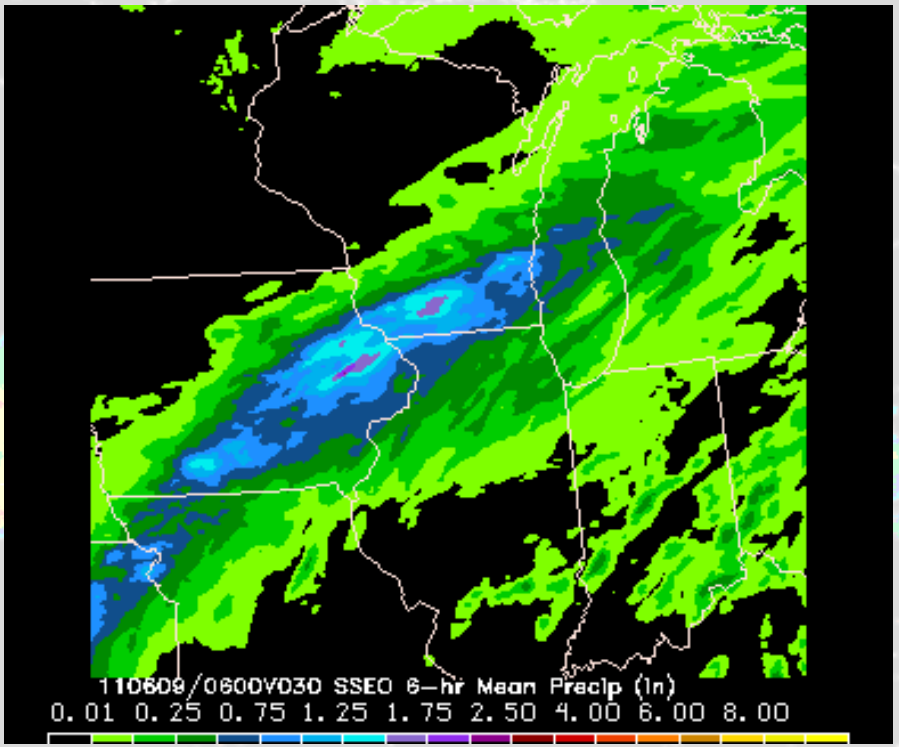


Forecast Valid 06Z 9 June 2011

6hr NSSLQ2 QPE valid 06Z 9 June 2011

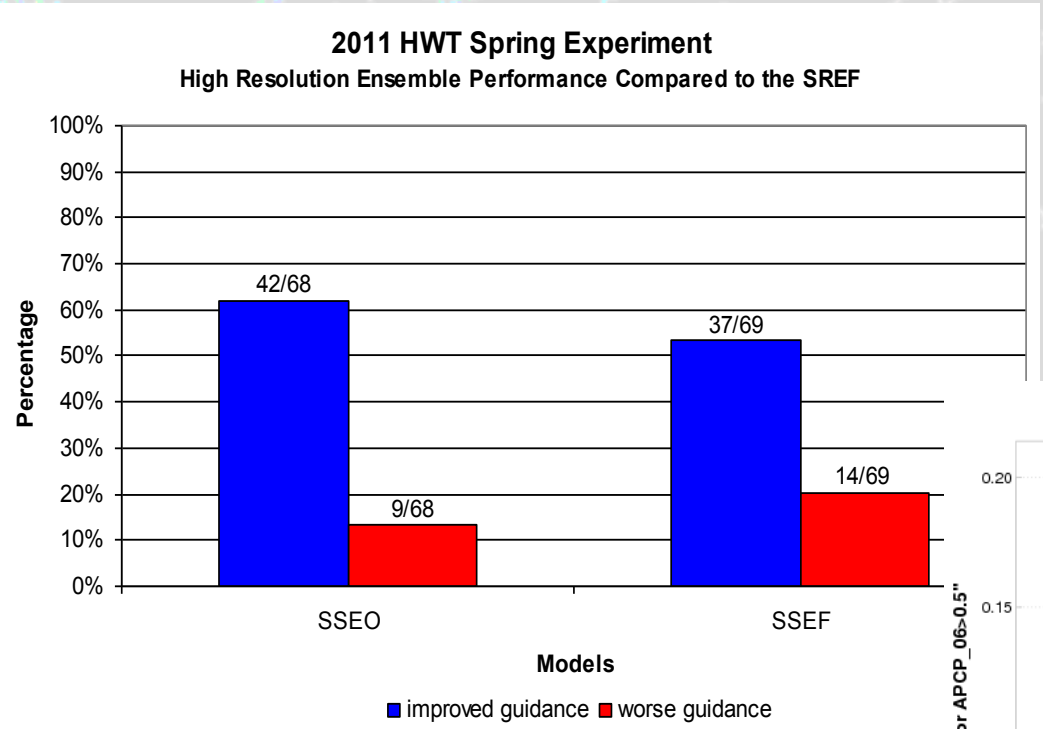


SSEO mean 6 hr QPF (30 hr forecast)

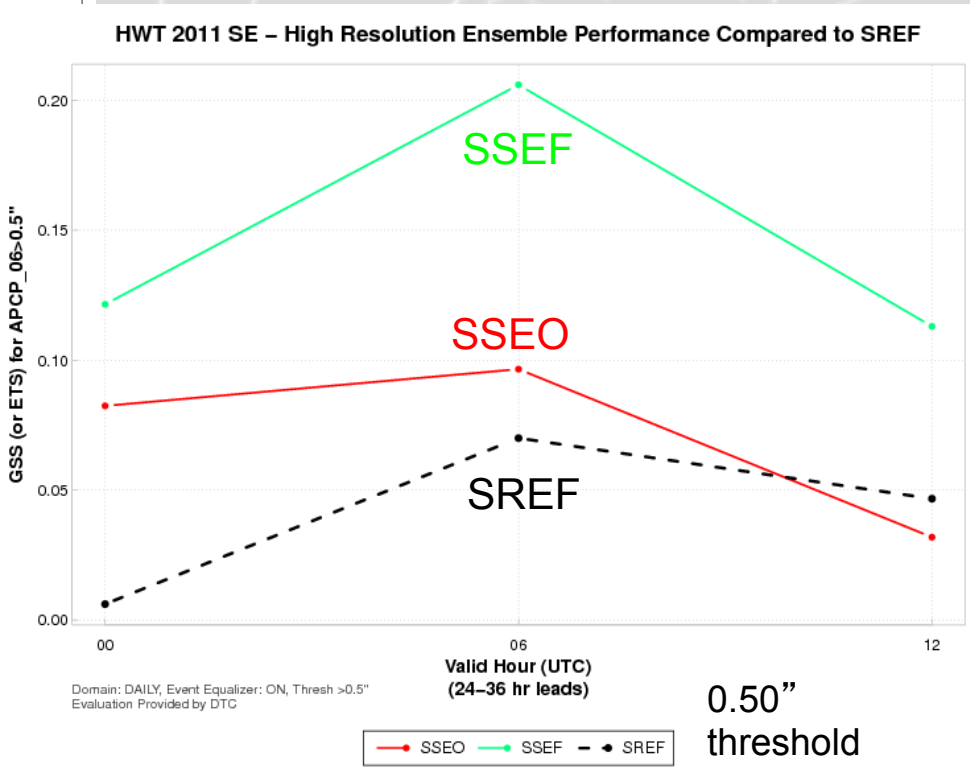


Results—Ensembles

Subjective Verification



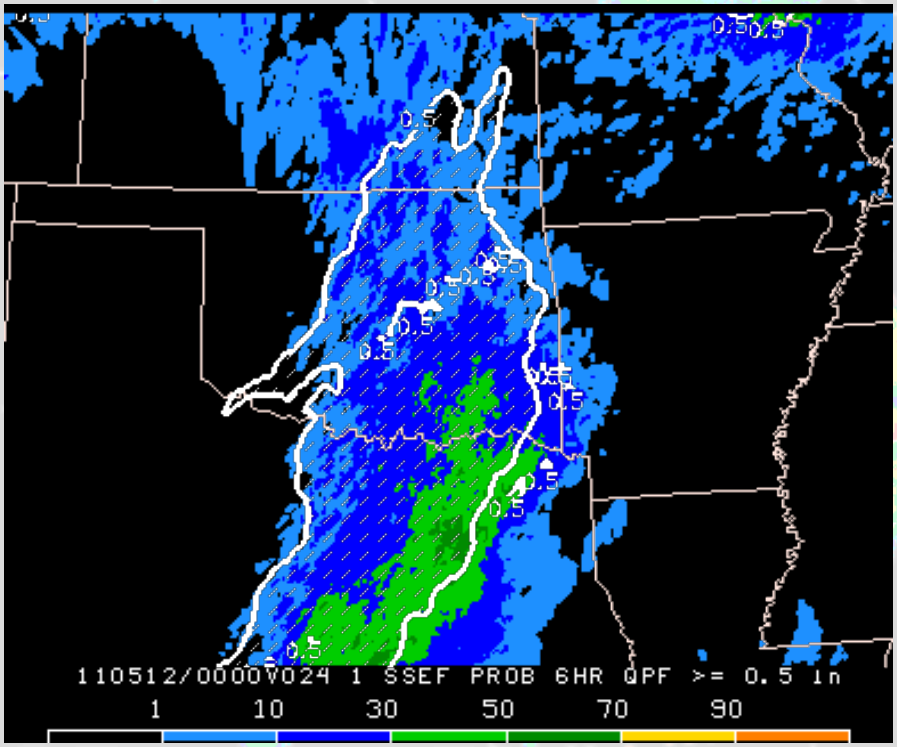
DTC Objective Verification



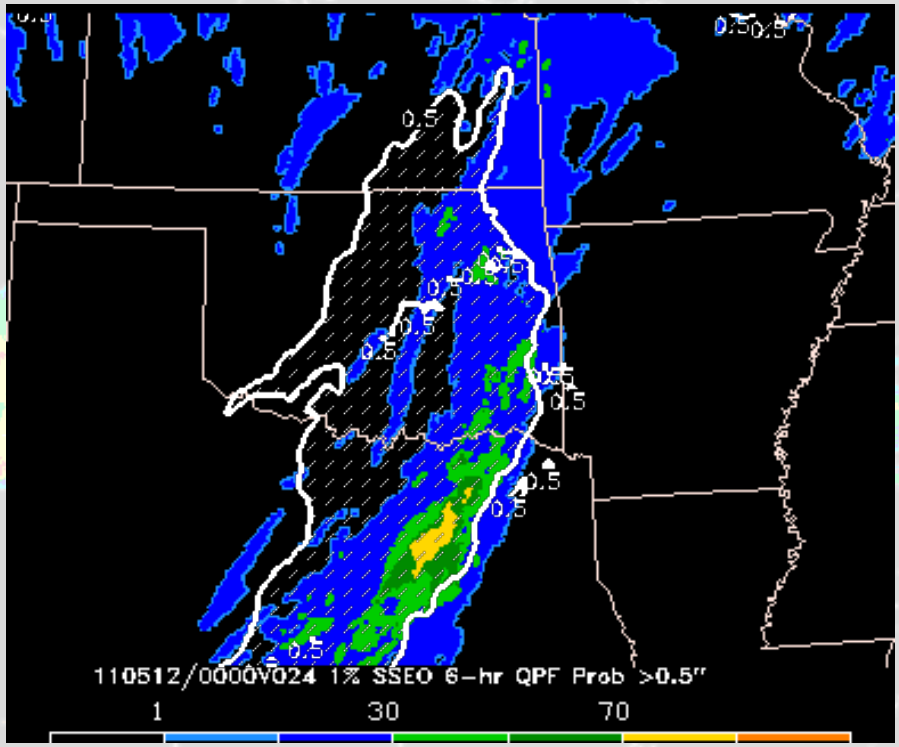
0.50” threshold

Forecast Valid 00Z 12 May 2011

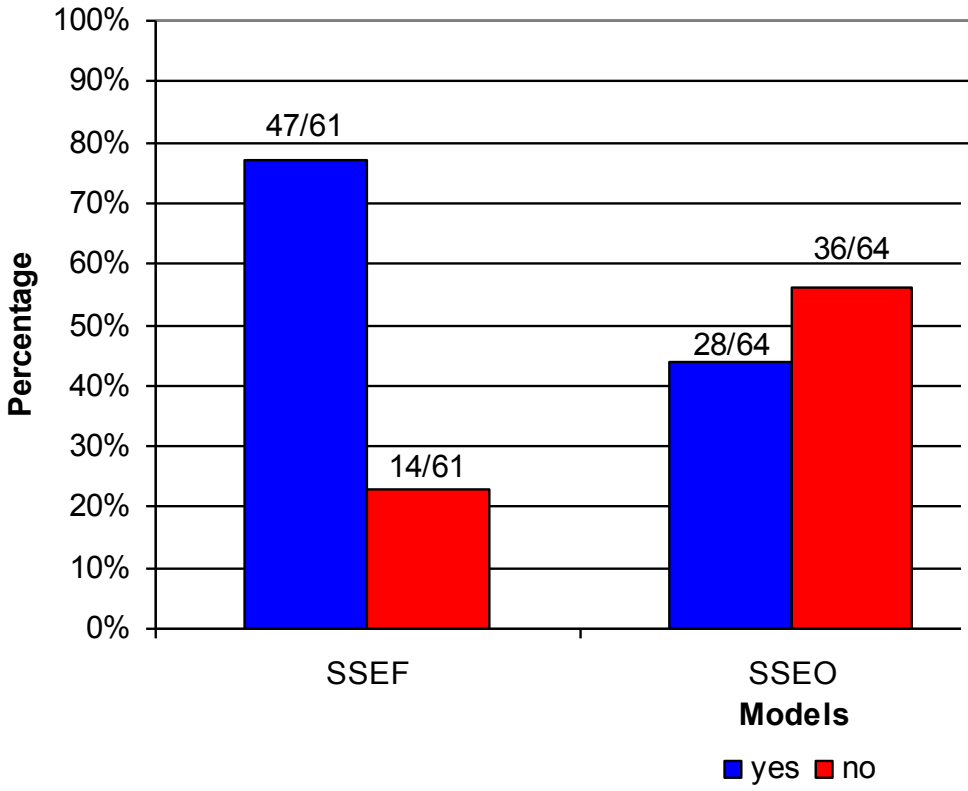
SSEF probability of exceeding 0.50”/6 hr
(24 hr forecast)

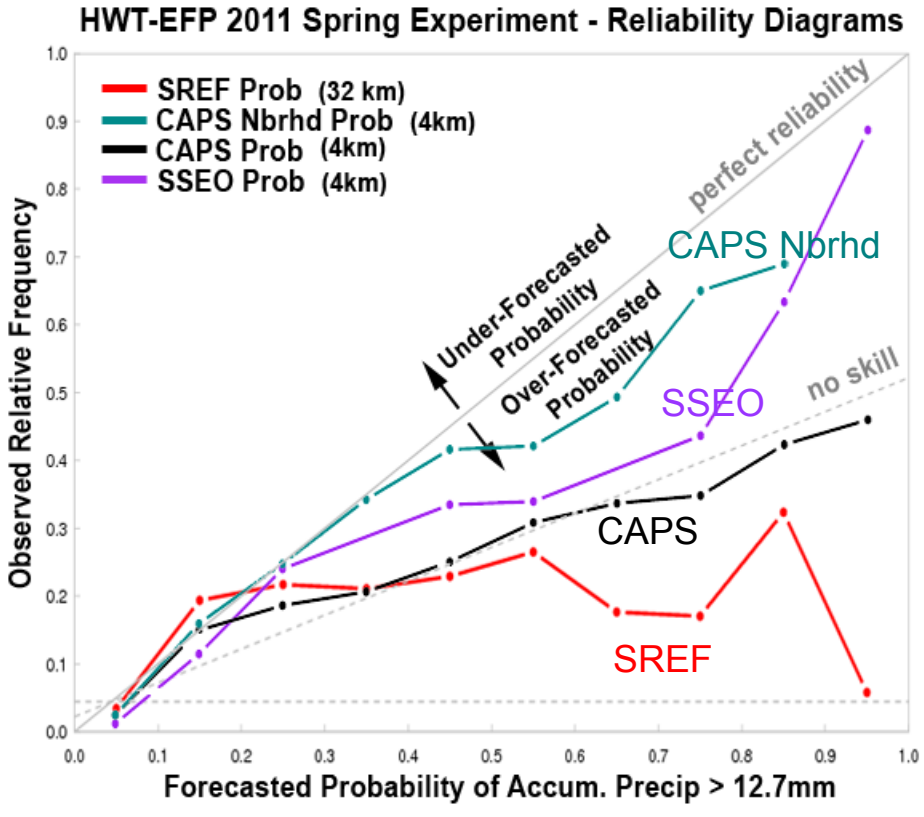


SSEO probability of exceeding 0.50”/6 hr
(24 hr forecast)



Results—Ensembles

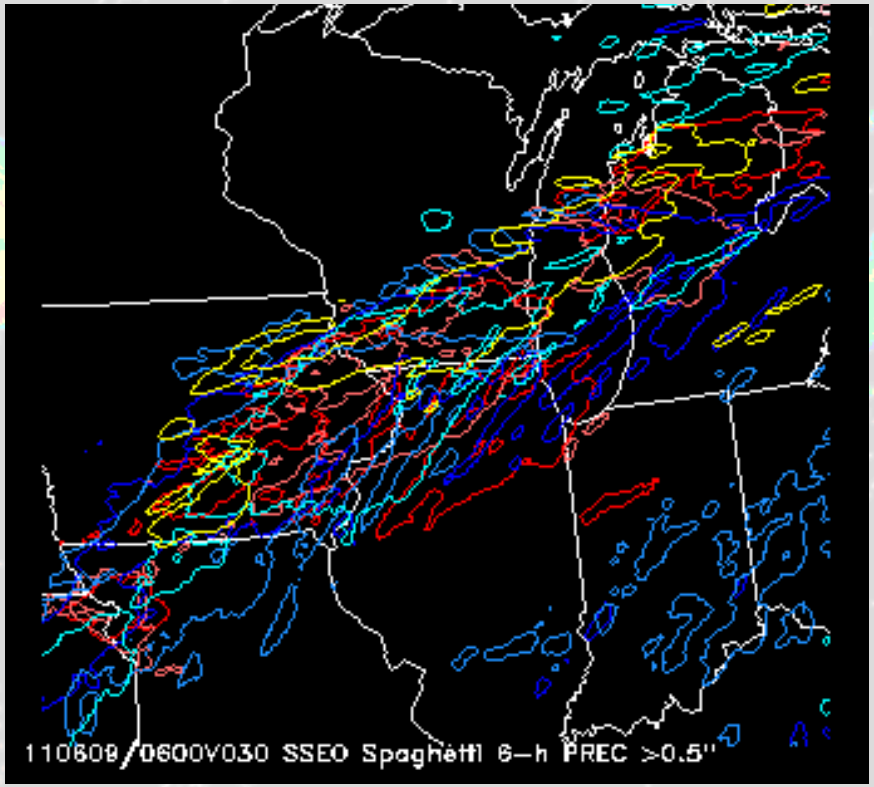




Operational Impact

- Small membership "poor man's" ensembles can provide valuable forecast guidance
  - Can be run in real time at an operational center

- Spaghetti plots are a useful way to display information from multiple high resolution models on one display



Operational Impact

- Builds confidence in the use of high resolution models and ensembles

547 AM EDT TUE JUL 20 2010
VERY FRUSTRATING QPF PATTERN…
PIECES OF SHRTWV ENERGY FIRING CNVCTN WHICH THEN…BEGINS TO TAKE ON A LIFE OF ITS OWN…THE BULK OF MODEL GUIDANCE HAS WOUND UP BEING TOO FAR NORTH WITH THE AXIS OF HEAVIEST PCPN. **THE HI RES ARW HAS DONE A MUCH BETTER JOB THAN NCEP AND NON-NCEP MODEL SUITES IN SHOWING THIS SRN DISPLACEMENT**...

Conclusions and Future Work

- Participating in the HWT Spring Experiment has had a positive impact on HPC operations
  - Forecasters exposed to cutting edge research
  - Participation in testbed activities considered a reward
- SSEO performance demonstrates that a small membership "poor man's" ensemble can provide useful QPF guidance
  - SSEO available at HPC
- Displays such as spaghetti plots can be used to condense information from multiple sources into a single visualization
- Working with NSSL to develop the Intense Precipitation/ Flash Flooding (IPFF) supplement to the HWT

Full report available at: http://www.hpc.ncep.noaa.gov/hmt/2011_SpringExperiment_summary.pdf